

Scientific Research in the Kingdom of Saudi Arabia: Potential for Excellence and Indicators of Underdevelopment

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Abstract

This study analyzes the status of scientific research and development efforts in the Kingdom of Saudi Arabia, and then sheds lights on the potential for excellence in this area in terms of organization and structure, financing and partnership, and human resources. Accordingly, the study reviews both achievements and indicators of underdevelopment in the subject mentioned above.

Keywords: research, universities, King Abdulaziz City of Science and Technology, Saudi companies, scholarship

1. Introduction

Scientific research is the basis of national development and its vehicle for progress. Both developed and developing countries focus on scientific research because of its pivotal role in modernizing societies, solving persistent problems, and producing theoretical knowledge and practical applications that promote development and progress. Accordingly, the Kingdom of Saudi Arabia has given special consideration to scientific research in the main policies of its Eighth Development Plan in order to promote scientific innovation, as well as develop universities and other research and development centers. This focus on research also aims at encouraging developmental research activities in the private sector, facilitating co-operation among research institutions, making advanced technologies accessible, and facilitating the resettlement and establishing of technology gardens and its business incubators (Ministry of Economy and Planning, 2005).

2. Background

Universities, King Abdulaziz City for Science and Technology, and a total of 175 governmental and private organizations are responsible for maintaining and supervising research and development in the Kingdom of Saudi Arabia. Out of a population of 100,000, only 23 are scientific researchers. This is a modest rate compared to some developed countries where up to 500 individuals for every 100,000 are scientific researchers.

Beyond the modest amount of scientific researchers currently working in the Kingdom of Saudi Arabia, spending on research and development is also modest when compared to the research budgets of other developed or rapidly growing countries, representing only about 0.3% of the gross domestic product. For this reason, national policy aims to increase research funding to reach 2.10% of the gross domestic product by 2015 (Ministry of Economy and Planning, 2005).

Ideally, more national funding would increase the amount of research conducted in the Kingdom of Saudi Arabia, and improve its quality. An examination of the current status of research carried out in the country indicates that 2,699 studies were conducted during the period between 1991 and 2003, distributed among the following disciplines: medicine (36.8%), engineering (23.2%), agriculture (20.5%), and basic sciences (17.7%). Fifty-three point four percent of these studies fell under the category of applied research, 10.3% were categorized as development research, and 36.3% were considered basic research. The paragraphs below summarize the current situation of research across various sectors in greater detail.

2.1 Universities

In the above-mentioned examination of research conducted in the Kingdom of Saudi Arabia, results indicated that activity-focused, university-based research was distributed across 57 research centers. More specifically, the

number of studies conducted during the first four years of the research development plan, 1991 through 2004, was 1,631 distributed across different fields. There were 375 studies in the field of agricultural sciences, 359 studies on engineering sciences, and 344 research studies in the field of human sciences. These studies investigated issues related to water and environment engineering sciences, health sciences, and humanities.

2.2 King Abdulaziz City of Science and Technology

A total of seven research and development institutes, as well as two centers for mathematics and physics affiliated with King Abdulaziz City of Science and Technology represent the largest share of the research endeavors and development efforts in the Kingdom. The number of research projects supported by the Seventh Development Plan is about 429, costing 116.71 million dollars.

2.3 Saudi Companies

Research and development activities in Saudi companies have increased in recent years. This increase is reflected in higher numbers of research and development centers, especially for large companies such as ARAMCO, SABIC, and Metals, which have taken leading roles in the development process. The research investments of two of these companies range between 0.4% and 1.7%, according to the Seventh Development Plan. SABIC has carried out several scientific research projects to achieve its strategic goals, as well as improve operational performance and the development of production technology. A good indicator of research growth in this company is that the number of employees in its research centers has increased to 500. Moreover, it has more than 200 patents, in addition to more than 90 patent applications. ARAMCO also has nearly 400 employees in research, which has resulted in the company's registration of 17 patents that can be used commercially.

3. Potential for Excellence

3.1 Organization and Structure

One of the general goals of the Eighth Development Plan, first approved by the Council of Ministers No.175 for the development of science and technology in 2003, is to support scientific research and technological advances in order to enhance the efficiency of the national economy and keep up with global trends. Specifically, the Eighth Development Plan focuses on achieving the following strategies with regard to scientific research:

1. Resettlement, and the systematic and progressive development of techniques to boost the economy and develop the social sector in the Kingdom, in addition to increasing productive efficiency and enhancing competitive advantages.
2. Strengthening the capacity and contribution of scientific research and technical development of existing research centers, and establishing new centers.
3. Mutual exchange of advanced technologies between the Kingdom and advanced nations.
4. Developing community awareness of the importance of science and technology, and supporting the development of creativity, talent, and human capacities in the above fields.
5. Encouraging the establishment of technical parks and business incubators.
6. Development of regulations and institutional bodies that monitor and oversee the performance of newer systems of scientific research, technology, and innovation.

In addition to strengthening organization and structure through the above-mentioned strategies identified in the Eighth Development Plan, the Kingdom also worked to increase the number of ministry and governmental research centers to 46 by the end of the Seventh Development Plan. Their research activities are focused on issues in the fields of medicine, engineering, agriculture, water desalination, environmental studies, and humanities. Two thousand one-hundred nineteen studies were conducted at these centers during the Seventh Development Plan.

Overall, the government's intent in increasing the country's number of research centers during the Seventh Development Plan was to establish institutions that promote creativity and innovation, and raise awareness of the scientific and technical support available to innovators. The most prominent examples are King Abdulaziz and his companions' Foundation for Giftedness and Creativity, and the Riyadh Charitable Foundation for Science, which created the Prince Salman Scientific Oasis to raise public awareness of the importance of science. Beyond these examples, there are more than 45 scientific associations distributed across different universities that play an important role in supporting the activities of scientific and technical organization in the Kingdom. Accordingly, many research chairs are in Saudi universities. For instance, there are 125 chairs at King Saud University, of which 62 chairs are donated (Mission of the University, 51B0/2113).

3.2 Funding and Partnership

Based on its future vision for science and technology, the government is increasing spending on research and development, which should reach 2% of GDP by 2025. During the Seventh Development Plan, total budget allocations were 1674.9 million Saudi riyal for development programs in the sector of science and technology, which represents 116% of the total proposed in the plan. The King Abdulaziz City for Science and Technology supported 429 projects at an expense of 116.71 million Saudi riyal.

3.3 Human Resource Achievements

Intellectual production has witnessed a remarkable development in the Kingdom of Saudi Arabia, where the number of scientific publications has jumped from 3,700 in 1982 to reach 108,200 in 2000. The number of students on scholarships increased from 11,917 in 2003 to more than 140,000 in 2011. In the final stages of the scholarship program, the Ministry of Higher Education limited their plan to meet needs for MA and PhD students in medicine and engineering only (Deputyship for Planning and Information, 2010). Of all students, 23.5% were MA students and 5.0% were PhD students. Fellowship students constituted 1.7%, which was the smallest percentage of all. Most students studied in the United States and Britain.

4. Indicators of Underdevelopment

4.1 Organization and Structure

The narrow scope of scientific research in the Arab world can be traced back to the absence of a clear strategy for research in Arab countries. In our region, individuals rather than institutions conduct research. Lack of sufficient budget share is another main reason for scarcity of scientific research (Salman, 1993). In a similar vein, Alaidors (2001) suggested that although Saudi universities produce thousands of theses, the lack of strategic planning and clear-cut policies for scientific research may lead to disorder and a lack of service development.

The limited success of higher education in achieving its goals, especially with regard to scientific research, is reflected in its lack of attention to scientific and applied research. For higher education to realize its scientific research goals, cultural, environmental, and social hurdles restricting the proliferation and wide support of scientific research should be removed. One way that research centers might resolve cultural, environmental, and social issues is by recruiting distinguished researchers and professors to both work in the centers, as well as promote scientific research around the Kingdom (Manea, 2002).

Saudi universities have 75 research centers, but they suffer from a predominance of bureaucratic regulations that limit the effectiveness how university functions perform and weaken regulatory and structural frameworks. Dawid (2005) asserted that the prevalence of red-tape in university research centers creates hurdles that limit the production and publication of research papers. In addition, complex administrative procedures delay, and in some cases, restrict participation in scientific conferences. Finally, the predominance of theoretical research chairs of humanities and social sciences over research chairs of hard sciences further limits the advancement of scientific research at universities, as well as the adoption of non-specialized universities for scientific research chairs.

4.2 Funding and Partnership

The percentage of total spending on the activities of scientific research and development in both the public and private sectors is only 0.3% of Saudi gross domestic product, which does not match the national demand for scientific and technological development and innovation. The average capita per quota spending on scientific research in any Arab Country does not exceed 10 dollars a year. For comparison, Malaysia's capita per quota spending on scientific research is 33 dollars, while even small European countries, such as Ireland and Finland, spend 575 dollars and 1,304 dollars on scientific research respectively (Nimri, 2011). Spending on research and development to total investment in capital companies, including ARAMCO, SABIC, and Metals ranged between 0.4% and 1.7% during the period of the Seventh Development Plan. In comparison, total private-sector funding for scientific research in Japan is 67% and in the United States is 63% (Dudin, 2009).

4.3 Human Resource Achievements

The percentage of employees in the activities of scientific research and development is 0.023 of the Saudi population, which means 23 persons of every 100,000 people work in research and development. This rate is very modest when compared to rates of developed countries, 500 persons working in research and development for every 100,000 persons.

The number of patents registered in the United States during the period between 1980 and 1991 was 2,000, while in Saudi Arabia only 171 patents were registered. The number of patents registered in Saudi Arabia can also be

compared with Korea, where 16,328 patents were registered, and Egypt, where 77 patents were registered. It should be noted that the patents of the Arab countries include a large proportion of patents registered by foreign companies (Arab Human Development Report, 2003).

According to Statistics King Fahd National Library, the ratio of books published in the fields of applied science and pure science is 19% only of total books published. In 1987, the total number of published research articles cited more than 40 times in the United States was 10,481. In the same year the Kingdom of Saudi Arabia had only one article that was quoted at the same rate (Arab Human Development Report, 2002). Scientific and technological communities in universities in the Gulf area have hefty teaching loads. As a result, research activities account for no more than 5% of the work load of a faculty member. Al-Rumaihi (2000) found that Gulf states ignored universities and established independent research centers because universities were formulated to serve the function of teaching only.

5. Conclusion

This study analyzed the state of scientific research and developmental efforts in the Kingdom of Saudi Arabia. The study looked at the current state of scientific research and the potential for improvement in terms of organization and structure, financing and partnership, and human resources. It is evident that it the Kingdom is trailing developed countries in term of the number of researchers and funding. The study concluded that the total funding for scientific research in the Kingdom amounted to .03% of gross domestic product, which is modest compare to developed nations' budget for research. However, the Kingdom is aiming to increase funding for research to the amount of 2.0% of the total gross domestic product by 2015. The Kingdom's long-term goal is to increase the level of cooperation among government agencies, universities, and privet sectors organizations. There are over 59 research centers among these groups; the government has lion share of 46 centers. These centers focus on research in fields of medicine, engineering, agriculture, environmental studies, and humanities.

King Abdulaziz City of Science and Technology has the largest share of research funding in the Kingdom, totaling 116.71 million dollars. In the private sector, Saudi companies have been increasing their funding toward research and development. A good indicator that companies are spending more on research and development is their increase in the number of researchers and patents applications. However, it is worth mentioning that companies such as ARAMCO, SABIC, and Metals are leading the way when it comes to research and development.

The Eighth Development Plan objectives with regard to scientific research are: (a) development of the economy and social sector, (b) strengthening the capacity and contribution of existing research centers and building new ones, (c) better cooperation between the Kingdom and advanced nations, (d) promoting awareness among citizens, (e) encouraging the establishment of technical parks and business incubators, and (f) developing regulation and evaluation standards.

It is evident that the Kingdom is progressing with regard to scientific research and development. The plan to increase funding to 2% of the total gross domestic product is significant. Also the scholarships awarded to students to study abroad increased from 11,917 in 2003 to 140,000 in 2011. These are excellent steps which will give the Kingdom an edge in order to compete in a global environment. Nevertheless, the state of scientific research in the Arab world is dismal at best. Many of the problems are due to shortage of funding, red tape, old regulations, and a lack of cooperation. The limited number of patents and scientific papers published is very small compare to other nations such as the United States and Korea. In order for the Kingdom to achieve a place among the advanced nations, it is mandatory to remove all the obstacles that hinder scientific research and development progress.

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